

REMARKS

The Examiner is thanked for the Official Action of November 2, 2005. Currently, claims 1-13 are pending and were rejected by the Examiner in the office action. This request for continued examination is intended to be fully responsive thereto. The Applicant submits a declaration under 37 C.F.R. § 1.132 to support his argument of patentability.

REJECTION UNDER 35 U.S.C. 102 (Hayashi et al.)

Claims 1-10 are rejected under 35 U.S.C. 102(b) As being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Hayashi et al. (JP 8-287951). Claims 1-5 and 11-13 are rejected under 35 U.S.C. 103(a) as obvious over Bai et al. (US 5744258) in view of Hayashi et al. Furthermore, claims 6-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai et al. in view of Hayashi et al. as applied to claims 1-5 and 11-13 above, and further in view of Dahn et al. (US 4969254).

The examiner suggested that the Oyama reference discloses that a polyaniline that demonstrates electronic conductivity is obtained by oxidation of the reduced polyaniline in an acidic atmosphere. The examiner continued that to this extent, the Encyclopedia of Smart Materials shows that polyaniline, when in an oxidized state, has a high ion exchange capacity.

The applicant respectfully disagrees with the examiner's opinion and interpretation of the Encyclopedia of Smart Materials and the references. The applicant submits the attached declaration to support the following argument.

Electric Conductivity of Electronic Conductive Polymer

"Ion conductivity" in the chemical field, as well as in this application, means the condition where ions migrate between polymer chains to achieve electric conductivity

where conductivity occurs due to the migration of ions with mass. Unlike electronic conductivity of a carrier, i.e., free electron or electron/positive hole, such as carbon black and polyaniline, ions migrate according to the mobility (spot/local activity) of macromolecule as solvating ions in the macromolecule site, thereby achieving electric conductivity.

The electronic conductive polymers simply means polymers having a conjugated double bond showing electric conductivity by doping, e.g., polyacetylene, polypyrrole, or polyaniline. These polymers, when doped in halogen and Lewis acid, cause a reaction between the polymers and the additive, thereby generating an electron/positive hole. This electron/positive hole becomes the carrier and causes electric conductivity. This is called p-type doping.

Halogen: Cl_2 , Br_2 , I_2 , ICl_3 , IBr , IF_3

Lewis Acid: PF_5 , AsF_5 , SbF_5

Here, the doping material reacts with the polymer to generate the electron/positive hole or free electron; however, the doping material itself has mobility within electrolyte but does not provide electric conductivity.

Understanding of Encyclopedia of Smart Materials

The second paragraph in "SYNTHESIS AND PROPERTIES" in the second column of page 297 in "Encyclopedia of Smart Materials" states "the dopant action A is electrostatically attached."

Here, the ions cause a chemical reaction as bonded with polymers and generate the carrier. To sum up, the ions are bonded with the polymers to become non-migratable and instead generate the carrier. This migrates on the conjugated system PAI electron orbit to provide conductivity. Therefore, if the dopant is once attached the dopant cannot migrate. Accordingly, it must logically and commonly be understood that no ion-conductivity can exist.

Furthermore, in the "Encyclopedia of Smart Materials", lines 13-14 in the first column of page 280, MA salt or HA acid (i.e., ion material) is incorporated to cause a

reaction between the dopant and polymer to generate carrier. On lines 12-14 in the second column of page 280, "[t]he doped oxidized form exhibit good electrical conductivity..., while the reduced forms have very low conductivity..." In other words, conductivity occurs only when being bonded with polymers. The chemical formula showing this phenomena is FORMULA (1) at page 281. Here, the polymer and dopant (A^-) reacted and + over polymer shows polymer/positive hole (carrier). The condition that A^- does not react with the polymer, i.e., the condition that A^- is being detached from the polymer (de-doping), shows the mixture of A^- and the polymer/positive hole quenched polymer, and therefore no mechanism of conductivity via the polymer exists. That is, this FORMULA (1) has nothing to do with ion conductivity.

What Is Ion Exchange Capacity

In the "Encyclopedia of Smart Material", the polymer with many carriers generated by doping is shown as "high ion exchange capacity". However, "high ion exchange capacity" and "ion conductivity" are totally different.

Final Summary

Doping effect for electronic conductivity causes the doped material to be fixed at the doped location; polyaniline is an example thereof. The doped material is fixed in the polymer and therefore the doped material cannot migrate therein. That is, (oxidant of) polyaniline is an electronic conductive material but NOT an ion conductive material. This fact is obvious from the "Encyclopedia of Smart Materials."

CONCLUSION

No cited reference discloses or suggests an ion-conducting polymer able to dissolve at least the lithium salts at a concentration of at least 0.1M (moles/l) and shows an electrical conductivity of 10^{-8} S (siemens)/cm at room temperature when dissolved with the lithium salts at a concentration of at least 0.1M. The advantages of employing this polymer are supported by the current specification and the above experiment.

Accordingly, it is respectfully submitted that claims 1-13 define the invention over the prior arts and notice to this effect is respectfully solicited.

Should Examiner believe further discussion regarding the above claimed language would expedite prosecution he is invited to contact the undersigned at the number listed below.

Respectfully submitted,

By. 

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